10019746 .081902 PCT/AU00/00839
Received 27 September 2001
ART 34 AMDT

We Claim:

1. A method of forming a grating structure in a photosensitive waveguide, the method comprising the steps of:

- dividing an input coherent beam into at least three coherent beams;
- transmitting the three coherent beams through respective optical pathes in a manner such that they interfere at a first predetermined position;
- modulating/adjusting the relative phase and/or the intensity of at least one of the coherent beams; and
- placing a photosensitive waveguide at the predetermined position so as to form the grating structure comprising different order gratings super-imposed at the predetermined position through refractive index changes induced in the photosensitive waveguide.

2. A method as claimed in claim 1, wherein the step of dividing the input beam comprises diffraction of the input beam.

3. A method as claimed in claim 2, wherein the dividing of the input coherent beam into three coherent beams utilises a phasemask.

4. A method as claimed in claims 2 or 3, wherein the three coherent beams are made up from two first order diffracted beams and one zero order diffracted beam.

5. A method as claimed in claim 1, wherein the dividing of the input coherent beam utilises at least two mirrors of less than 100% reflection.

6. A method as claimed in claims 1 or 5, wherein the transmission along the optical pathes utilises at least two refractive elements for reflecting two of the beams so as to direct them to the predetermined position.

7. A method as claimed in any one of the preceding claims, wherein the method further comprises the step of tuning a period of the resulting grating structure.

AMENDED SHEET
IPEA/AU

PCT/AU00/00839
Received 27 September 2001
ART 34 AMDT

8. A method as claimed in claim 7, wherein the tuning of the period is effected through tilting of the or reflective elements utilised in the transmitting of the three coherent beams.

9. A method as claimed in any one of the preceding claims, wherein the method comprises the step of tuning a shape of the resultant refractive index profile in the photosensitive waveguide.

10. A method as claimed in claim 9, wherein the tuning of the shape is effected by adjusting the relative intensities of the interfering three coherent beams.

11. A method as claimed in any one of the preceding claims, wherein the method comprises the step of switching between the writing of different order gratings.

12. A method as claimed in claim 11, wherein the switching is effected by selectively blocking out at least one of the three coherent beams.

13. A method of writing a grating structure in a photosensitive waveguide, the method comprising the steps of:

- dividing an input coherent beam into two *nth* order beams and a zero order beam utilizing a phase mask, wherein *nth* is equal to or greater than first;
- placing a photosensitive waveguide substantially adjacent a surface of the phase mask where the *nth* order beams and the zero order beam overlap;
- modulating/adjusting the intensity of the zero order beam transmitted by the phase mask such that a grating structure comprising different order gratings superimposed is created through refractive index changes induced in the photosensitive waveguide.

14. A method as claimed in claim 13, wherein the formed grating structure comprises a grating having a non-sinusoidal profile along a light propagation direction of the wave guide.

AMENDED SHEET
IPEA/AU

15. A method as claimed in claim 13 or 14, wherein the grating comprises a first order grating.

16. A method as claimed in any one of claims 13 to 15, wherein the grating structure comprises a higher order grating.

17. A method as claimed in any one of claims 13 to 16, wherein the grating structure comprises different order gratings superimposed.

18. A method as claimed in claim 17, wherein the grating structure comprises a first and second order gratings superimposed.

19. An apparatus for writing a grating structure in a photosensitive waveguide, the apparatus comprising:

- means for dividing an input coherent light beam into at least three coherent beams;

- means for modulating/adjusting the relative phase and/or the intensity of at least one of the coherent beams; and

- an optical circuit for transmitting each of the three coherent beams to a predetermined position so as to form an interference pattern at the first predetermined position for, in use, writing the grating structure comprising different order gratings super-imposed through refractive index changes induced in the photosensitive waveguide.

20. An apparatus as claimed in claim 19, wherein the apparatus comprises at least one modulation means for modulating/adjusting the phase and/or intensity of one of the beams relative to the others.

21. An apparatus as claimed in claims 19 to 20, wherein the means for dividing the input beam comprises diffraction means.

22. An apparatus as claimed in any one of claims 19 to 21, wherein the three beams comprise the zero order diffraction and two first order diffraction beams.

23. An optical filter comprising a grating structure written in accordance with any one of claims 1 to 18.

24. A filter as claimed in claim 23, wherein second order modulation in the grating structure results, in use, in the emission of filtered light energy substantially perpendicular to a core axis of the waveguide.

25. A filter as claimed in claims 23 or 24, wherein the filter comprises a chirped second order grating which transmits predetermined wavelengths of light energy substantially perpendicular to a core axis of the waveguide and at predetermined positions along the waveguide.

26. A filter as claimed in any one of claims 23 to 25, wherein the grating structure comprises a grating comprising a first order grating and the second order grating superimposed.

27. An optical free space coupler comprising a first grating structure written in accordance with the method as claimed in any one of claims 1 to 18.

28. A coupler as claimed in claim 27, wherein the first grating structure is formed within a first optical waveguide and is arranged to provide the emission of filtered light energy substantially perpendicular to a core axis of the first waveguide; and a second grating structure formed within a second optical waveguide placed in the path of emission of the filtered light energy can couple a portion of the filtered light energy along the second optical waveguide, and wherein at least one of the first or second grating structures comprises a second order grating.

29. A coupler as claimed in claim 28, wherein at least one of the first or second grating structures comprises a first order grating and a second order grating superimposed.

30. An optical sensor comprising a grating structure written in accordance with the method as claimed in any one of claims 1 to 18.

10019746.081902 PCT/AU00/00839
Received 27 September 2001
ART 34 AMDT

31. A sensor as claimed in claim 30, wherein the grating structure comprises a second order grating formed within an optical waveguide, the grating structure having a predetermined second order modulation so as to provide for the reciprocal emission of optical energy substantially perpendicular to the optical waveguide; the sensor further comprising an optically sensitive material spaced adjacent to the optical waveguide, the material having optical reflective properties variable in accordance with an external physical parameter, the material reflecting the emitted optical energy from the grating structure back to the grating structure.

32. A sensor as claimed in claims 30 or 31, wherein the grating structure comprises a first order grating and the second order grating.

33. A grating structure written in accordance with the method as claimed in any one of claims 1 to 18 into an optical fibre.

34. A device for suppressing ripples in a dispersion compensator in an optical fibre, the device comprising a grating structure written in accordance with a method as claimed in any one of claims 1 to 17 for providing an optical loss mechanism to effect the suppressing of the ripples.

35. A device as claimed in claim 34, wherein the grating structure comprises a second order grating.

36. A device as claimed in claims 33 or 34, wherein the grating structure comprises a first order grating and a second order grating superimposed.

37. A dispersion compensator for compensating dispersion in an optical fibre, the compensator comprising a grating structure written in accordance with a method as claimed in any one of claims 1 to 18 for providing an optical loss mechanism for suppressing ripples.

38. A compensator as claimed in claim 37, wherein the grating structure comprises a higher order grating.

10018746 .081902 PCT/AU00/00839
Received 27 September 2001

ART 34 AMDT

39. A compensator as claimed in claims 37 or 38, wherein the grating structure comprises a second order grating.

40. A compensator as claimed in any one of claims 37 to 39, wherein the grating structure comprises a first order grating and a second order grating superimposed.

AMENDED SHE...
IPEA/AU